Rules and Principles for determining the dispersive Ratio of Glass; and for computing the Radii of Curvature for achromatic Object-Glasses, submitted to the Test of Experiment. By Peter Barlow, *Esq. F.R.S. Mem. Imp. Ac. Petrop. &c.* Read May 3, 1827. [*Phil. Trans.* 1827, *p.* 231.]

The author begins this paper by an enumeration of the various works on the subject extant in our language, and a general mention of the writings of foreign mathematicians, which he considers as leaving room for further inquiry and simplification. He then states the method employed in his experiments for determining the refractive and relative dispersive powers of his glasses, the former of which is that generally known and practised;—of measuring the radii and focal length of a lens, and thence deriving the refractive index; with some refinements in its practical application, consisting chiefly in using the lens as the object-glass of a telescope, and adapting to it a positive eye-piece and cross-wires, which are brought precisely to the true focus by the criterion of the evanescence of parallax arising from a motion of the eye, as is practised in adjusting the stops of astronomical instruments. The only source of error it involves is in the measurement of radii of the tools which it was found could always be performed within $\frac{1}{500}$th of their whole values. The dispersive ratio of two glasses was determined by over-correcting the dispersion of a convex lens of the less dispersive glass by a concave of the greater, and then withdrawing the latter from the former till the achromaticity is perfect, or as nearly so as the materials will admit, and measuring the interval between the lenses and their foci, from which data the ratio of their dispersive powers is easily obtained.

The refractive indices and dispersive ratio thus determined, the next step is to find the radii of curvature so as to destroy spherical aberration. In this investigation, the author does not consider it as necessary to limit the indeterminate problem by any further condition, as others before him have done, but regarding it as a matter of great convenience to avoid contact of the interior surfaces in the centre of the glasses, leaves it open to the optician to make a choice within certain limits, thus avoiding what he considers as an intricate equation arising out of the fourth condition. He proceeds, therefore, to express analytically the aberrations of the glasses, and to deduce the equation expressive of its destruction, which of course involves one indeterminate quantity; this may be either of the radii, or any combination of them. The author chooses the ratio of the radii of the interior and exterior surfaces of his flint lens for this indeterminate, which he assumes, as well as may be, to satisfy the condition of the absence of contact and near equi-curvature of the adjacent surfaces; thence deduces, first, the radii of both of the surfaces of the flint lens; next, its aberration to be corrected; and thence, by the solution of a quadratic, or by the use of a table containing its solutions registered in various states of the data, the ratio

of the radii of the convex, whence the radii themselves are easily deduced.

Mr. Barlow next inquires into the validity of the empirical rule employed by Mr. Tulley, as stated in Rees's Cyclopædia, which in many usual cases he finds to give results nearly agreeing with his own computations; in others, however, it differs too widely to be depended on.

The author next enters on an experimental inquiry of the limits within which an error in spherical aberration or dispersion may have taken place without producing a sensible defect in the object-glass, by procuring, with the assistance of Mr. Gilbert, glasses to be ground to radii nearly, but not quite agreeing with the results of computation. It results from them, that in some states of the data and assumed radii, much greater deviations may be borne than in others, and the author considers that such combinations should be preferred as admit the greatest latitude in this respect.

The author concludes this paper by a synoptic statement of a mode of approximate solution applicable (in consequence of the peculiarity of the formula for the destruction of the spherical aberration) to all ordinary states of the data, and comprised in a very short and easily calculable form; and by a method of practically determining the curvatures and indices of refraction of any given convex or concave lens.

On the Change in the Plumage of some Hen-Pheasants. By William Yarrell, *Esq. F.L.S. Communicated by* William Morgan, *Esq. F.R.S., March* 19, 1827. Read May 10, 1827. [*Phil. Trans.* 1827, *p.* 268.]

The last shooting season having been unusually productive of hen-pheasants, which have assumed more or less the plumage and appearance of the male, much discussion in consequence has arisen on the cause of this change; and the author having had many opportunities of examining the facts, both as respecting the pheasant and domestic fowl, was induced to notice the internal peculiarities which invariably accompany this transformation. According to an opinion of Mr. J. Hunter and of Mr. Butter, this change only takes place at an advanced age; but the author considers the facts in his possession as at variance with this idea, and that the appearances in question may occur at any period of life, and may even be produced artificially.

In all the instances examined by him, the sexual organs were found diseased, and to a greater or less extent in proportion to the change of plumage. The ovarium was shrunk, purple, and hard; the oviduct diseased, and the canal obliterated at the upper part, immediately preceding its funnel-shaped enlargement at the bottom of the ovarium. Having opened a hen-pheasant in its natural plumage, for the sake of comparison, he found a similar diseased state of the organs to exist; thus proving that the disease must exist some time before the corresponding change of feathers takes place.